J C Branner

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CHARLES D. WALCOTT, DIRECTOR

THE

EL PASO TIN DEPOSITS

BY

WALTER HARVEY WEED

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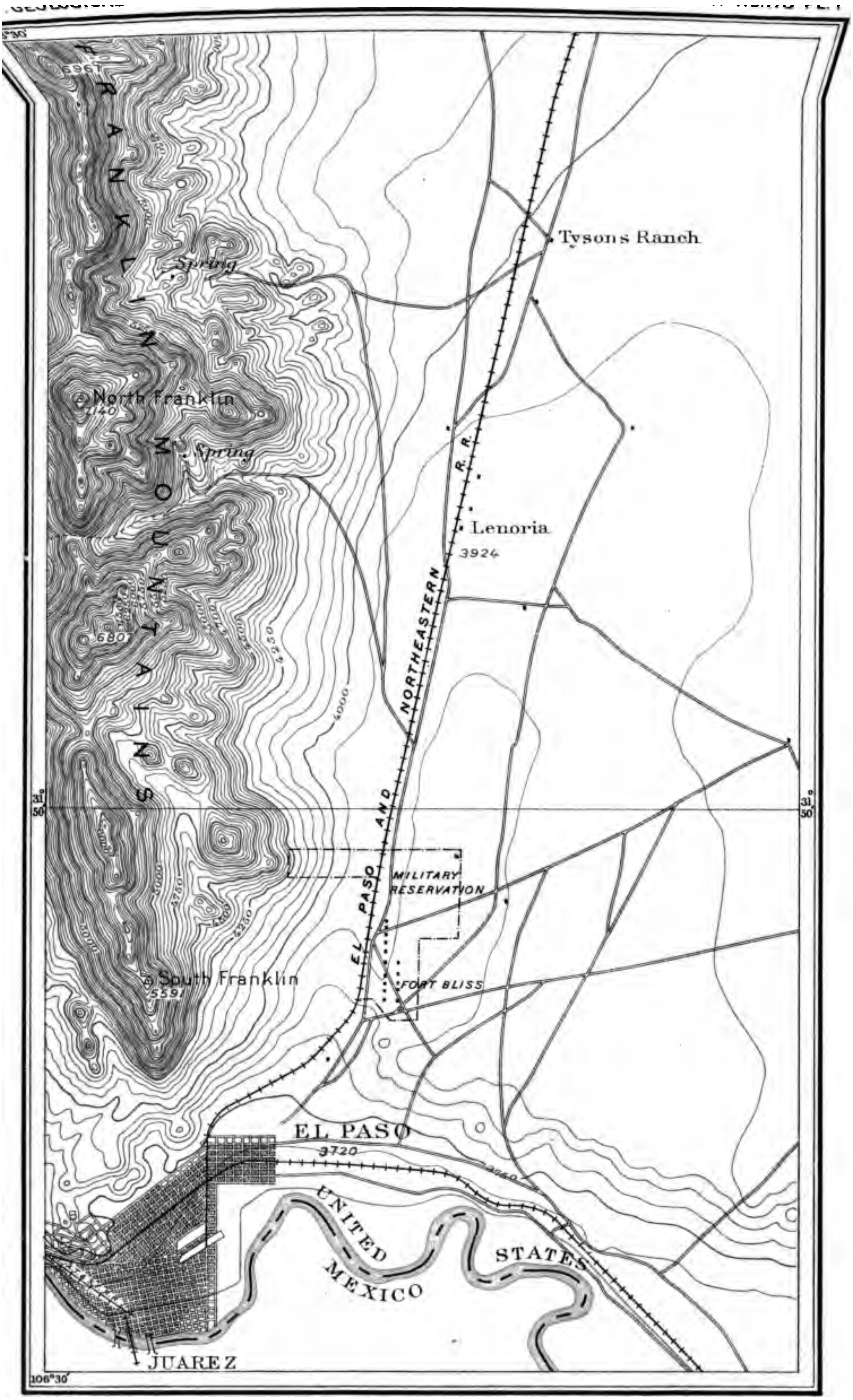
DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., March 19, 1901.

SIR: In December, 1900, specimens of tin ore were submitted to the Survey for examination. They proved to contain abundant cassiterite and wolframite in a quartz gangue. They were said to come from the vicinity of El Paso, Texas, and in view of the infrequency of well-authenticated occurrences of tin ore in the United States it was judged wise to have their provenance and manner of occurrence verified at the earliest opportunity. This opportunity presented itself when, in January, 1901, Mr. W. H. Weed had occasion to pass through El Paso, and he was instructed to make a reconnaissance examination of the locality whence the specimens were said to come. The result of his examination is presented briefly in the following report, the immediate publication of which I recommend.

S. F. EMMONS,
Geologist in Charge of Section of Metalliferous Ores.

HON. CHARLES D. WALCOTT,
Director of United States Geological Survey.



PORTION OF THE EL PASO QUADRANGLE

THE EL PASO TIN DEPOSITS.

By W. H. WEED.

LOCATION OF DEPOSITS.

The El Paso tin deposits lie on the east flank of the Franklin Mountains, the southern extension of the Organ or San Andreas Range, about 10 miles north of the city of El Paso. The ores were discovered in 1899 and have been prospected by several open cuts and pits, the deepest of which is about 50 feet below the surface. The property belongs to Judge C. R. Moorhead, of El Paso, to whom I am indebted for many courtesies during my visit to the deposits. The place is distant about 14 miles by wagon road from El Paso, 12 miles of excellent road across the flat mesa being succeeded by 2 miles across the foothills. The White Oaks Railroad crosses the flat 3 or 4 miles east of the property, and the main line of the Southern Pacific lies 10 miles to the south. There is a good spring one-fourth of a mile from the ledges, but there is no large supply of water nearer than the Rio Grande. The mesa is underlain by water, the city of El Paso being supplied from driven wells sunk in the mesa gravels. The mesa is scantily grassed and covered with the usual desert vegetation of small yucca and cactus, while the mountain slopes show cedar bushes, with mesquite, yucca, sotol, and other arid-land plants. The mountains show a very regular crest of bedded rocks surmounting smoother basal slopes of a prevailing red-brown color dotted by green sotol bushes.

GEOLOGICAL STRUCTURE AND FORMATIONS.

The geological structure is very simple and is easily made out, as the mountains are not wooded, but show outcropping edges of the upturned limestones and bare slopes of red granite. The mountain range consists of Cambrian and other Paleozoic limestones, upturned by and resting upon an intrusive mass of coarse-grained granite that forms the central core of the range. This granite is well exposed for a distance of 4 or 5 miles along the eastern side of the mountains, forming the lower half of the mountains proper, and in places extending out to the foothills. The crest of the range consists of steeply tilted, heavily bedded, dark-gray limestones dipping westward. The basal quartzites

were observed in the drift seen in arroyos, so that the granite is probably intruded between the base of the Cambrian rocks and the underlying Archean complex.

The eastern foothills consist mainly of limestones, but near the tin deposits these bedded rocks have been cut through and granite now forms the surface, remnants of the limestone cover showing as isolated masses capping the hillocks. These relations are shown in the diagram, fig. 1, which is a rough sketch of the range, representing a cross section at the tin mines. North of the place where this section was made a transverse ridge of the range shows the granite to be sheeted by well-marked planes, dipping eastward at an angle of about 45° to 50°. The granite is very much altered by surface decomposition, and crumbles readily to a coarse sand. No fresh material was observed anywhere on the surface, but fairly good material was obtained from the dump heap of the shaft on the north vein. The granite is sheeted near the veins, the planes of sheeting being parallel to the veins themselves. The general sheeting, however, is in a different direction, the average strike

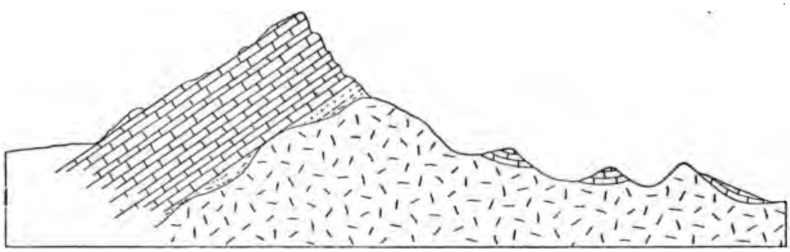


FIG. 1.—Cross section of Franklin Mountains 10 miles north of El Paso, Texas.

being N. 20° E, and the dip 70° SE. A thin section of this granite has been examined under the microscope by Mr. Lindgren, who furnishes the following notes:

The rock is a coarse-grained normal granite. It shows much anhedral quartz with anhedral feldspar, largely microperthite, with some few grains of microcline. A few small flakes of brownish-green hornblende and some small grains of magnetite were also seen. The rock is a soda granite.

White aplite-granite occurs in veinlets and irregular masses intrusive in the granite, but none was observed close to the veins. The mesa is underlain by cemented gravels, which form also the lower slopes of the foothills.

ORES AND VEINS.

The ores consist of cassiterite, or oxide of tin, with wolframite (tungstate of iron and manganese) in a gangue of quartz. Specimens of nearly pure cassiterite weighing several pounds have been found on the surface, and this mineral occurs in the quartz, either alone or associated with wolframite. The most abundant ore is a granular mixture

of tin ore and quartz which resembles a coarse granite and corresponds to the greisen ore of European tin deposits. Pyrite occurs rarely in the eastern exposures of the vein, but appears to constitute the bulk of the metallic contents in exposures seen in the westernmost openings. These ores occur in well-defined veins, which run up the slopes nearly at right angles to the direction of the range, the strike being approximately east-west and the veins dipping steeply to the north. Three veins have been discovered, all of which have been exposed by open-cut work and by pits for several hundred feet in length. The most northerly vein is traceable along the surface for a distance of about 1,200 feet. The middle vein lies about 300 feet south of the east end of the northern one, but apparently converges westward toward the northern vein. The southern vein, which is the smallest of the three, lies about 600 feet farther south.

The veins exhibit the usual characters of the European tin veins, notably those of Cornwall, England, their clearly defined fissures showing a central core or lead of coarse quartz, sometimes containing tin ore, and flanked on either side by altered rock in which the tin ore replaces the feldspar of the granite. Where this metasomatic replacement is complete the ore shows a mixture of cassiterite, with or without wolframite and quartz. Where the replacement is only partial the greisen ore fades off into the unaltered granite. A cross section of the veins shows, therefore, the same phenomena seen at Cornwall. The diagram, fig. 2, shows an ideal representation of the conditions existing in the veins, and has been drawn from sketches made in the field.

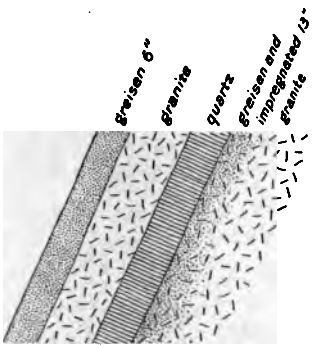


FIG. 2.—Section of tin vein exposed in open cut (north vein).

The central mass of quartz corresponds to the "leader" of the Cornish veins. It is composed of massive, coarsely crystalline quartz, sometimes showing comb structure, and it is clearly the result of the filling of the open fissure by quartz. The adjacent ore-bearing material is a replacement deposit in which the mineral solutions have substituted ore for the feldspar of the granite by metasomatic action; in other words, the main mass of the ore occurs alongside of a quartz vein, and is due to the alteration of the granite forming the walls of the fissure. In general, the ore passes into the granite by insensible transition and there are no distinct walls.

A thin section of the greisen ore has been examined by Mr. Lindgren, who furnishes the following notes:

The thin section of the tin ore shows it to be a quartz-cassiterite rock. It is a coarsely granular rock consisting of anhedral quartz, with which is intergrown grains of slightly brownish cassiterite. The quartz is full of fluid inclusions and makes

up about 75 per cent of the mass. The cassiterite grains are, along the edges, intimately intergrown with quartz. If this is a metasomatic form of the granite a silicification has taken place. The microscope affords no direct evidence, however, that this ore is metasomatic. One small grain of tourmaline and a few flakes of sericite were seen. Neither topaz nor mica occurs in the section, and no remains of feldspar were observed.

The north vein has a course of N. 85½° W. magnetic, as determined from the openings at the east end. At the west end of the workings the course observed, looking back along the outcrop, appears to be N. 80° E. for the northern vein and N. 80° W. for the middle vein; so that if these observations are correct the veins must intersect toward the west. The surveys by the owners of the property show a course N. 85½° W. for the middle and 65° W. for the south vein.

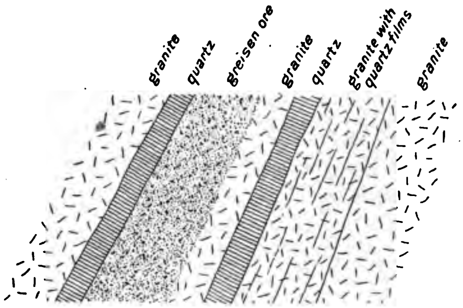


FIG. 3.—Section of north vein (6 feet across).

DEVELOPMENT.

A shaft 35 feet deep has been sunk on the north vein at the eastern end of the vein outcrop. This shaft is about 5 by 10 feet across and shows a very well-defined vein about 5 feet wide, having a dip of about 70° to the north. The sides of the shaft show excellent ore, mostly of the greisen variety, extending down for 8 to 15 feet below the top. At this point a slip crosses the shaft and cuts out the ore. This slip, or fault, is a clay seam but one-fourth to one-half inch in thickness, and seems to have thrown the upper part of the vein to the north. The lower half of the shaft reveals only rusty granite, shattered and showing films of quartz, but without recognizable ore. A crosscut south from the bottom of the shaft should reach the vein if the fault is a normal one. In the exposure seen in the upper part of the shaft the ore occurs in bunches in altered granite and lies on the north side of a 15-inch streak of sheeted and rusty quartz. A second shaft on the north vein has been sunk at a point about 300 feet west of the one just noted. This shaft is about 25 feet deep. The vein is well exposed at the top, and shows a dip northward, but the shaft passes out of the vein into the sheeted granite, forming the foot wall. A crosscut about 8 feet in length, driven from the bottom of the shaft, cuts the vein, but does not pass through it. The sheeting of the granite seen in this shaft is very pronounced, the rock being divided into plates from one-fourth inch to 12 inches in thickness

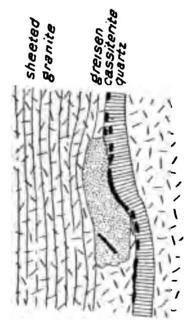


FIG. 4.—Greisen bowlder in tin vein (shaft on middle vein).

by planes dipping 61° E. and crossing the vein at 90°. The outcrop of the vein is traceable westward up the slopes by its rusty quartz, and a nearly continuous ledge can be followed. This outcrop has been opened at intervals of a few yards by trenches, which expose the vein and show it to have a thickness of from 2 to 6 feet, with about half this thickness of ore. No samples were, however, taken, and it is uncertain whether the altered granite does not contain a percentage of tin oxide. The most westerly working that could be surely identified as being upon the north vein is a pit 6 feet deep, which shows a 6-foot vein in which the quartz is bluish in color and the tin ore is associated with much pyrite. This point is about 600 or more feet west of the first shaft. West of this point the ledge can not be traced across the slopes, but an opening north a hundred feet higher and a few hundred feet farther west shows a good vein, carrying much pyrite, but devoid of any recognizable tin ore.

The middle vein is developed by a shaft 50 feet deep. which shows a vein having a central leader of quartz 2 feet wide at the top and tapering to 1 foot 4 inches wide at the bottom of the shaft. The dip, as shown by the walls of the shaft, is 70° N. The central quartz mass is spotted with cassiterite, and the altered granite on either side contains recognizable grains of tin oxide.

The south vein lies 500 to 600 feet south of the middle vein. This vein is much narrower than the veins on the north, having an average width of about 1 foot. The strike, as shown near the shaft, is N. 50° W. and the dip 50° N. The vein walls are sometimes defined by a clay selvage one-sixteenth inch wide, but more often show a gradual fading off into the granite.

CONTINUANCE OF VEINS IN DEPTH.

It will be noticed from what has been said that the veins are all well defined at the surface and carry good values in tin ore, but that the ore apparently dies out in depth. Further development is needed to establish the existence of the ore at a greater depth than 50 feet, but it is believed that the veins have been thrown by local slips or faults and will be found by crosscutting from the bottom of the present workings. The character of the fissures and the nature of the ore both indicate that the veins are the result of deep-seated agencies, and are not merely segregations due to descending surface waters. For this reason it is believed that further exploration will develop well-defined tin veins. The absence of topaz in the deposit is noteworthy, for this mineral is commonly associated with cassiterite veins the world over. In other respects the deposits closely resemble the tin veins of Europe, and are clearly due to metasomatic processes. The evidence of a pneumatolitic origin is, however, not conclusive.

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ADVERTISEMENT.

[Bulletin 178.]

The statute approved March 3, 1879, establishing the United States Geological Survey, contains the following provisions:

"The publications of the Geological Survey shall consist of the annual report of operations, geological and economic maps illustrating the resources and classification of the lands, and reports upon general and economic geology and paleontology. The annual report of operations of the Geological Survey shall accompany the annual report of the Secretary of the Interior. All special memoirs and reports of said Survey shall be issued in uniform quarto series if deemed necessary by the Director, but otherwise in ordinary octavos. Three thousand copies of each shall be published for scientific exchanges and for sale at the price of publication; and all literary and cartographic materials received in exchange shall be the property of the United States and form a part of the library of the organization; and the money resulting from the sale of such publications shall be covered into the Treasury of the United States."

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33. Storage of Water on Gila River, Arizona, by Joseph B. Lippincott. 1900. 8°. 98 pp. 33 pl.
34. Geology and Water Resources of SE. South Dakota, by J. E. Todd. 1900. 8°. 34 pp. 19 pl.
35. Operations at River Stations, 1899, Part I. 1900. 8°. 100 pp.
36. Operations at River Stations, 1899, Part II. 1900. 8°. 101-198 pp.
37. Operations at River Stations, 1899, Part III. 1900. 8°. 199-298 pp.
38. Operations at River Stations, 1899, Part IV. 1900. 8°. 299-396 pp.
39. Operations at River Stations, 1899, Part V. 1900. 8°. 397-471 pp.
40. The Austin Dam, by Thomas U. Taylor. 1900. 8°. 51 pp. 16 pl.
41. The Windmill; Its Efficiency and Economic Use, Pt. I, by E. C. Murphy. 1901. 8°. 72 pp. 14 pl.
42. The Windmill; Pt. II (Continuation of No. 41). 1901. 8°. 73-147 pp. 15-16 pl.
43. Conveyance of Water, by Samuel Fortier. 1901. 8°. 86 pp. 15 pl.
44. Profiles of Rivers, by Henry Gannett. 1901. 8°. 100 pp. 11 pl.

In press:

45. Water Storage on Cache Creek, California, by A. E. Chandler.
46. Physical Characteristics of Kern River, California, by F. H. Olmsted, and Reconnaissance of Yuba River, California, by M. Manson.
47. Operations at River Stations, 1900, Part I.
48. Operations at River Stations, 1900, Part II.
49. Operations at River Stations, 1900, Part III.
50. Operations at River Stations, 1900, Part IV.

TOPOGRAPHIC MAP OF THE UNITED STATES.

When, in 1882, the Geological Survey was directed by law to make a geologic map of the United States, there was in existence no suitable topographic map to serve as a base for the geologic map. The preparation of such a topographic map was therefore immediately begun. About one-fifth of the area of the country, excluding Alaska, has now been thus mapped. The map is published in atlas sheets, each sheet representing a small quadrangular district, as explained under the next heading. The separate sheets are sold at 5 cents each when fewer than 100 copies are purchased, but when they are ordered in lots of 100 or more copies, whether of the same sheet or of different sheets, the price is 2 cents each. The mapped areas are widely scattered, nearly every State being represented. About 1,100 sheets have been engraved and printed; descriptive circulars concerning them may be had on application.

The map sheets represent a great variety of topographic features, and with the aid of descriptive text they can be used to illustrate topographic forms. This has led to the projection of an educational series of topographic folios, for use wherever geography is taught in high schools, academies, and colleges. Of this series the first three folios have been issued, viz:

1. Physiographic types, by Henry Gannett. 1898. Folio. Four pages of descriptive text and the following topographic sheets: Fargo (N. Dak.-Minn.), a region in youth; Charleston (W. Va.), a region in maturity; Caldwell (Kans.), a region in old age; Palmyra (Va.), a rejuvenated region; Mount Shasta (Cal.), a young volcanic mountain; Eagle (Wis.), moraines; Sun Prairie (Wis.), drumlins; Donaldsonville (La.), river flood plains; Boothbay (Me.), a fiord coast; Atlantic City (N. J.), a barrier-beach coast. Price 25 cents.

2. Physiographic types, by Henry Gannett. 1900. Folio. Eleven pages of descriptive text and the following topographic sheets: Norfolk (Va.-N. C.), a coast swamp; Marshall (Mo.), a graded river; Lexington (Nebr.), an overloaded stream; Harrisburg (Pa.), Appalachian ridges; Poteau Mountain (Ark.-Ind. T.), Ozark ridges; Marshall (Ark.), Ozark Plateau; West Denver (Colo.), hogbacks; Mount Taylor (N. Mex.), volcanic peaks, plateaus, and necks; Cucamonga (Cal.), alluvial cones; Crater Lake special (Oreg.), a crater. Price 25 cents.

3. Physical geography of the Texas region, by Robert T. Hill. 1900. Folio. Twelve pages of text (including 11 cuts); 5 sheets of special half-tone illustrations; 5 topographic sheets, one showing types of mountains, three showing types of plains and scarps, and one showing types of rivers and canyons; and a new map of Texas and parts of adjoining territories. Price 50 cents.

GEOLOGIC ATLAS OF THE UNITED STATES.

The Geologic Atlas of the United States is the final form of publication of the topographic and geologic maps. The atlas is issued in parts, or folios, progressively as the surveys are extended, and is designed ultimately to cover the entire country.

Under the plan adopted the entire area of the country is divided into small rectangular districts (designated *quadrangles*), bounded by certain meridians and parallels. The unit of survey is also the

unit of publication, and the maps and descriptions of each rectangular district are issued as a folio of the Geologic Atlas.

Each folio contains topographic, geologic, economic, and structural maps, together with textual descriptions and explanations, and is designated by the name of a principal town or of a prominent natural feature within the district.

Two forms of issue have been adopted, a "library edition' and a "field edition." In both the sheets are bound between heavy paper covers, but the library copies are permanently bound, while the sheets and covers of the field copies are only temporarily wired together.

Under the law a copy of each folio is sent to certain public libraries and educational institutions. The remainder are sold at 25 cents each, except such as contain an unusual amount of matter, which are priced accordingly. Prepayment is obligatory The folios ready for distribution are here listed.

No.	Name of sheet.	State.	Limiting meridians.	Limiting parallels.	Area, in square miles.	Price, in cents.
1	Livingston	Montana	110°-111°	45°-46°	3,354	25
2	Ringgold	Georgia Tennessee	85°-85° 30′	34° 30′-35°	980	25
3	Placerville	California	120° 30′-121°	38° 30′-39°	932	25
4	Kingston *a*	Tennessee	84° 30′-85°	35° 30′-36°	969	25
5	Sacramento	California	121°-121° 30′	38° 30′-39°	932	25
6	Chattanooga *a*	Tennessee	85°-85° 30′	35°-35° 30′	975	25
7	Pikes Peak *a*	Colorado	105°-105° 30′	38° 30′-39°	932	25
8	Sewanee	Tennessee	85° 30′-86°	35°-35° 30′	975	25
9	Anthracite-Crested Butte. *a*	Colorado	106° 45′-107° 15′	38° 45′-39°	465	50
10	Harpers Ferry	Virginia West Va. Maryland.	77° 30′-78°	39°-39° 30′	925	25
11	Jackson	California	120° 30′-121°	38°-38° 30′	938	25
12	Estillville	Virginia Kentucky Tennessee	82° 30′-83°	36° 30′-37°	957	25
13	Fredericksburg	Maryland. Virginia	77°-77° 30′	38°-38° 30′	938	25
14	Staunton	Virginia West Va.	79°-79° 30′	38°-38° 30′	938	25
15	Lassen Peak	California	121°-122°	40°-41°	3,634	25
16	Knoxville	Tennessee N. Carolina	83° 30′-84°	35° 30′-36°	925	25
17	Marysville	California	121° 30′-122°	39°-39° 30′	925	25
18	Smartsville	California	121°-121° 30′	39°-39° 30′	925	25
19	Stevenson	Alabama Georgia Tennessee	85° 30′-86°	34° 30′-35°	980	25
20	Cleveland	Tennessee	84° 30′-85°	35°-35° 30′	975	25
21	Pikeville	Tennessee	85°-85° 30′	35° 30′-36°	969	25
22	McMinnville	Tennessee	85° 30′-86°	35° 30′-36°	969	25
23	Nomini	Maryland. Virginia	76° 30′-77°	38°-38° 30′	938	25
24	Three Forks	Montana	111°-112°	45°-46°	3,354	50
25	Loudon	Tennessee	84°-84° 30′	35° 30′-36°	969	25
26	Pocahontas	Virginia West Va.	81°-81° 30′	37°-37° 30′	951	25
27	Morristown	Tennessee	83°-83° 30′	36°-36° 30′	963	25
28	Piedmont	Maryland. West Va.	79°-79° 30′	39°-39° 30′	925	25
29	Nevada City: Nevada City Grass Valley Banner Hill	California	 121° 00′ 25″-121° 03′ 45″ 121° 01′ 35″-121° 05′ 04″ 120° 57′ 05″-121° 00′ 25″	 39° 13′ 50″-39° 17′ 16″ 39° 10′ 22″-39° 13′ 50″ 39° 13′ 50″-39° 17′ 16″	 11.65 12.09 11.65	50
30	Yellowstone National Park: Gallatin Canyon Shoshone Lake	Wyoming.	110°-111°	44°-45°	3,412	75
31	Pyramid Peak	California	120°-120° 30′	44°-45°	932	25
32	Franklin	Virginia West Va.	79°-79° 30′	38° 30′-39°	932	25
33	Briceville	Tennessee	84°-84° 30′	36°-36° 30′	963	25
34	Buckhannon	West Va.	80°-80° 30′	38° 30′-39°	932	25
35	Gadsden	Alabama	86°-86° 30′	34°-34° 30′	986	25
36	Pueblo	Colorado	104° 30′-105°	38°-38° 30′	938	50
37	Downieville	California	120° 30′-121°	39° 30′-40°	919	25
38	Butte Special	Montana	112° 29′ 30″-112° 36′ 42″	45° 59′ 28″-46° 02′ 54″	22.80	50
39	Truckee	California	120°-120° 30′	39°-39° 30′	925	25
40	Wartburg	Tennessee	84° 30′-85°	36°-36° 30′	963	25
41	Sonora	California	120°-120° 30′	37° 30′-38°	944	25
42	Nueces	Texas	100°-100° 30′	29° 30′-30°	1,035	25
43	Bidwell Bar	California	121°-121° 30′	39° 30′-40°	918	25
44	Tazewell	Virginia West Va.	81° 30′-82°	37°-37° 30′	950	25
45	Boise	Idaho	116°-116° 30′	43° 30′-44°	864	25
46	Richmond	Kentucky	84°-84° 30′	37° 30′-38°	944	25
47	London	Kentucky	84°-84° 30′	37°-37° 30′	950	25

a Out of stock.

No.	Name of sheet.	State.	Limiting meridians.	Limiting parallels.	Area, in square miles.	Price, in cents.
48	Tenmile District Special.	Colorado	106° 8'-106° 16'	39° 22' 30"-39° 30' 30"	55	25
49	Roseburg	Oregon	123°-123° 30'	43°-43° 30'	871	25
50	Holyoke	Mass. Conn	72° 30'-73°	42°-42° 30'	885	50
51	Big Trees	California	120°-120° 30'	38°-38° 30'	938	25
52	Absaroka: Crandall Ishawooa	Wyoming.	109° 30'-110°	44°-44° 30'	1,706	25
53	Standingstone	Tennessee	85°-85° 30'	36°-36° 30'	963	25
54	Tacoma	Washington.	122°-122° 30'	47°-47° 30'	812	25
55	Fort Benton	Montana	110°-111°	47°-48°	3,273	25
56	Little Belt Mts	Montana	110°-111°	46°-47°	3,295	25
57	Telluride	Colorado	107° 45'-108°	37° 45'-38°	236	25
58	Elmoro	Colorado	104°-104° 30'	37°-37° 30'	950	25
59	Bristol	Virginia Tennessee	82°-82° 30'	36° 30'-37°	957	25
60	La Plata	Colorado	108°-108° 15'	37° 15'-37° 30'	237	25
61	Monterey	Virginia West Va.	79° 30'-80°	38°-38° 30'	938	25
62	Menominee Special	Michigan.	(a NW.-SE. area, about	22 m. long, 6¼ wide)	150	25
63	Mother Lode	California	(a NW.-SE. rectangle,	70 m. long, 6¼ wide)	455	50
64	Uvalde	Texas	99° 30 -100°	29°-29° 30'	1,040	25
65	Tintic Special	Utah	111° 55'-112° 10'	39° 45'-40°	229	25
66	Colfax	California	120° 30'-121°	39°-39° 30'	925	25
67	Danville	Illinois Indiana	87° 30'-87° 45'	40°-40° 15'	228	25
68	Walsenburg	Colorado	104° 30'-105°	37° 30'-38°	944	25
69	Huntington	West Va. Ohio	82°-82° 30'	38°-38° 30'	938	25
70	Washington	Maryland Dist. of Columbia Virginia	76° 45'-77° 15'	38° 45'-39°	465	50
71	Spanish Peaks	Colorado	104° 30'-105°	37°-37° 30'	950	25

STATISTICAL PAPERS.

Mineral Resources of the United States, 1882, by Albert Williams, jr. 1883. 8°. xvii, 813 pp. Price 50 cents.

Mineral Resources of the United States, 1883 and 1884, by Albert Williams, jr. 1885. 8°. xiv, 1016 pp. Price 60 cents.

Mineral Resources of the United States, 1885. Division of Mining Statistics and Technology. 1886. 8°. vii, 576 pp. Price 40 cents.

Mineral Resources of the United States, 1886, by David T. Day. 1887. 8°. viii, 813 pp. Price 50 cents.

Mineral Resources of the United States, 1887, by David T. Day. 1888. 8°. vii, 832 pp. Price 50 cents.

Mineral Resources of the United States, 1888, by David T. Day. 1890. 8°. vii, 652 pp. Price 50 cents.

Mineral Resources of the United States, 1889 and 1890, by David T. Day. 1892. 8°. viii, 671 pp. Price 50 cents.

Mineral Resources of the United States, 1891, by David T. Day. 1893. 8°. vii, 630 pp. Price 50 cents.

Mineral Resources of the United States, 1892, by David T. Day. 1893. 8°. vii, 850 pp. Price 50 cents.

Mineral Resources of the United States, 1893, by David T. Day. 1894. 8°. viii, 810 pp. Price 50 cents.

On March 2, 1895, the following provision was included in an act of Congress:

"*Provided*, That hereafter the report of the mineral resources of the United States shall be issued as a part of the report of the Director of the Geological Survey."

In compliance with this legislation the following reports have been published:

Mineral Resources of the United States, 1894, David T. Day, Chief of Division. 1895. 8°. xv, 646 pp., 23 pl.; xix, 735 pp., 6 pl. Being Parts III and IV of the Sixteenth Annual Report.

Mineral Resources of the United States, 1895, David T. Day, Chief of Division. 1896. 8°. xxiii, 542 pp., 8 pl. and maps; iii, 543-1058 pp., 9-13 pl. Being Part III (in 2 vols.) of the Seventeenth Annual Report.

Mineral Resources of the United States, 1896, David T. Day, Chief of Division. 1897. 8°. xii, 642 pp., 1 pl.; 643-1400 pp. Being Part V (in 2 vols.) of the Eighteenth Annual Report.

Mineral Resources of the United States, 1897, David T. Day, Chief of Division. 1898. 8°. viii, 651 pp., 11 pl.; viii, 706 pp. Being Part VI (in 2 vols.) of the Nineteenth Annual Report.

Mineral Resources of the United States, 1898, David T. Day, Chief of Division. 1899. 8°. viii, 616 pp.; ix, 804 pp., 1 pl. Being Part VI (in 2 vols.) of the Twentieth Annual Report.

Mineral Resources of the United States, 1899, David T. Day, Chief of Division. 1901. 8°. viii, 656 pp.; viii, 634 pp. Being Part VI (in 2 vols.) of the Twenty-first Annual Report.

The money received from the sale of the Survey publications is deposited in the Treasury, and the Secretary of the Treasury declines to receive bank checks, drafts, or postage stamps. All remittances, therefore, must be by MONEY ORDER, made payable to the Director of the United States Geological Survey, or in CURRENCY—the exact amount. Correspondence relating to the publications of the Survey should be addressed to—

THE DIRECTOR,
UNITED STATES GEOLOGICAL SURVEY,
WASHINGTON, D. C.

WASHINGTON, D. C., *May, 1901.*